

## Background Information

Functional groups are a foundational concept for Organic Chemistry students to master. Serving as the primary area for organic reactions to take place, it is seemingly impossible to learn Organic Chemistry and its mechanisms without them.<sup>1</sup> However, they are a common stumbling block due to structural similarities between related functional groups, and the vast variety of functional groups that appear in the course. Educational games have proven to be a very effective learning technique to reinforce concepts, not only in Chemistry, but in various other fields as well.<sup>2,3</sup> Chemistry games have taken shape in many different forms such as card games, escape rooms, and virtual games, but specifically, functional group card games have proved to be very effective in helping students learn functional groups.<sup>2,3</sup> A meaningful learning experience measured through knowledge acquisition or a change in student attitude towards the subject material.<sup>4</sup> These ideas and methods laid the foundation for a “Functional Group Field Day”: a series of mini games to help students learn and reinforce functional group knowledge and applications. Due to COVID-19, this **Functional Group Field Day (FGFD)** was adapted to fit an online format and was administered to Organic Chemistry and Intro to Organic Chemistry laboratory students through the streaming platform, Twitch.

## Field Day Setup

Participants were divided into groups of four and given a mutual space in Discord before the Field Day began. Each team had self selected roles: buzzing in (using QuizXpress), researching for the answer, communicating the answer to the instructor, and a floater, who assisted where needed.

The Field Day consisted of **five** events:

- **Select every compound that contained a certain functional group (MC)**
- **Heads Up:** The instructor held a functional group that they could not see, and each team buzzed in to give a clue to help the instructor guess the functional group.
- **Select the functional group not present in the structure (MC)**
- **Tile Matching:** See Figure 1
- **Reverse Google Search (MC):** Groups were provided with the names of four compounds and were told only one contained a certain functional group. Groups had to research to find the compound that contained the certain functional group, and the winner was awarded all points.

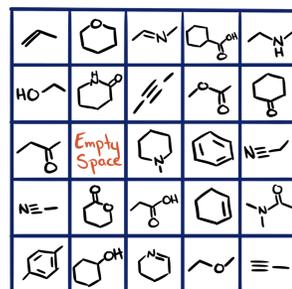


Figure 1. Tile Matching Game Example

## Research Methods

Participants were given a pre-FGFD survey as well as a post-FGFD survey using the learning management system, Canvas. Both surveys were **anonymous** and **unpaired**, and both surveys asked participants to rank their confidence identifying functional groups on a 1-10 scale where **1 is not very confident**, and **10 is very confident**. The pre- and post-surveys also inquired through open-ended questions about participant study habits and enjoyment of the FGFD, respectively. To ascertain if any significant changes in participant self-reported confidence occurred, a **one sample T-test** at **5% confidence** was utilized. In total, **fifteen** participants completed both the pre- and post-surveys with **two** participants not completing the post-survey.

## Research Data

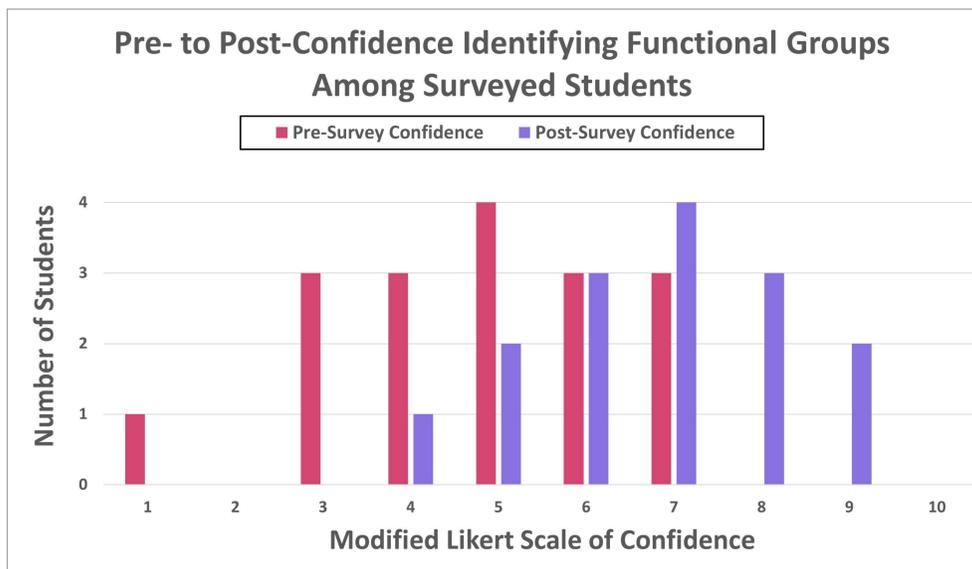


Figure 2. Graph of Pre- to Post-Survey Modified Likert Scale Confidence Data

	Pre-Survey	Post-Survey
Mean	4.764705882	6.8
Variance	0	2.171428571
Observations	2	15
$P(T \leq t)$ two-tail	0.000102577	

Table 1. One-Sample T-Test Data

## Participant Quotes From Post-Survey Data:

- **When asked about confidence post-FGFD:**  
“Yes, I found my group to be very helpful and encouraging. This made [it] more fun and easier to learn. The games we played also gave a very fun aspect to the lab today. I really hope we get to do this again soon.”
- **When asked about additional comments about the FGFD:**  
“My group member was mad ... because we didn't place first. So please have more of these activities so she can be a champ.”

## Results

### T-Test of Modified Likert Scale Confidence Survey:

Looking at the pre-FGFD survey data, the self-reported average of participant confidence was recorded to be **4.76**, and the self-reported average of participant confidence post-FGFD was recorded to be a **6.80**. A one-sample T-test indicated that this increase was **significant at 5% confidence** and corresponds to the open-ended question data where participants were asked to state if they thought their confidence had increased from pre- to post-FGFD. There was only one participant who indicated that they didn't think their confidence had not increased from pre- to post-FGFD; however, due to experimental design, it is not possible to pair their pre-survey to post-survey to check.

### Open-Ended Participant Feedback:

Overall, participants indicated that the Functional Group Field Day was a **valuable and beneficial learning tool** in learning and reinforcing functional group knowledge. Participants reported that the technology was difficult to use, and they would rather participate again in a face-to-face format; however, due to COVID-19, it was not possible at this time.

## Conclusions and Future Work

Overall, the FGFD participants self-reported confidence increased from an average of **4.76** on the Modified Likert Scale to **6.80** on the Modified Likert Scale from pre- to post-survey data. At a 5% confidence level, this is a **statistically significant increase**. When asked open ended questions about confidence, the majority consensus was that participants felt more confident identifying functional groups after participating in the FGFD. In the following months, we are working towards expanding this work in the form of a research paper. Once we can safely perform activities in a face-to-face format, we would like to host another FGFD and add new minigames.

## References

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- (2) Battersby, G. L.; Beeley, C.; Baguley, D. A.; Barker, H. D.; Broad, H. D.; Carey, N. C.; Chambers, E. S.; Chodaczek, D.; Blackburn, R. A. R.; Williams, D. P. Go Fischer: An Introductory Organic Chemistry Card Game. *J. Chem. Educ.* **2020**, *97* (8), 2226–2230. <https://doi.org/10.1021/acs.jchemed.0c00504>.
- (3) Welsh, M. J. Organic Functional Group Playing Card Deck. *J. Chem. Educ.* **2003**, *80* (4), 426. <https://doi.org/10.1021/ed080p426>.
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